Space Weather Technical Forecast

Issued on Saturday, 06 November 2021 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of M-class flares. Chance of isolated G1/Minor geomagnetic storms on days 2 and 3. Active electron fluence expected by days 3 and 4.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: There are currently three numbered regions on the visible disc. AR2891 (Cro/Beta) has continued to steadily fade, and has been re-classified to reflect it's weakened configuration. AR2893 (Cso/Beta) is little changed over the last few hours since the emergence of a small opposite polarity spot to the north of the main spot. Recently numbered region AR2894 (Hsx/Alpha) continues to transit into the southeast quarter, but it's proximity to the limb continues to make a complete assessment difficult at present. This is the source region of the largest flare in the past 24 hours, a C2 flare at 05/2156UTC. Solar activity has therefore bee Low.

No Earth-directed CMEs have been seen in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR and ACE at L1, has gradually and erratically reduced in speed following the passage of the 2nd November CME, although remain elevated near 530km/s. Density was mostly at average levels, but with occasional peaks above average levels, maximum peak 36 ppcc at 05/2317UTC. Total IMF, Bt, was initially moderate, 14 nT, but decreased erratically to mainly weak levels. The north-south component, Bz, was firmly positive, with an initial peak of +12 nT and also showed an erratic decrease to mostly weak levels, and only a brief negative peak of -2nT. Phi angle was mainly positive (away from the Sun) until around midday UTC, then became mostly negative thereafter. Quiet to Unsettled geomagnetic levels were observed through the period by BGS.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, has returned to background levels. The high energy electron flux (greater than 2 MeV) was at mostly moderate levels in the past 24 hours, with some brief peaks above the high threshold around the diurnal maximum, peak 1.82e3 at 05/1625UTC. The associated 24-hour electron fluence was below the Active (1e8 integrated pfu) threshold, but on a slow rising trend, with 4.49e7 integrated pfu recorded at 06/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain mainly Low through the next four days, but with a continuing slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: Solar wind speeds are expected to continue elevated at times, with a possible connection to CH17/+ from later on day 2 (7th). Quiet to Unsettled geomagnetic activity is expected through much of the period, but perhaps with an increased chance of Active to G1/Minor Storm intervals on days 2 to 3 (7th to 8th).

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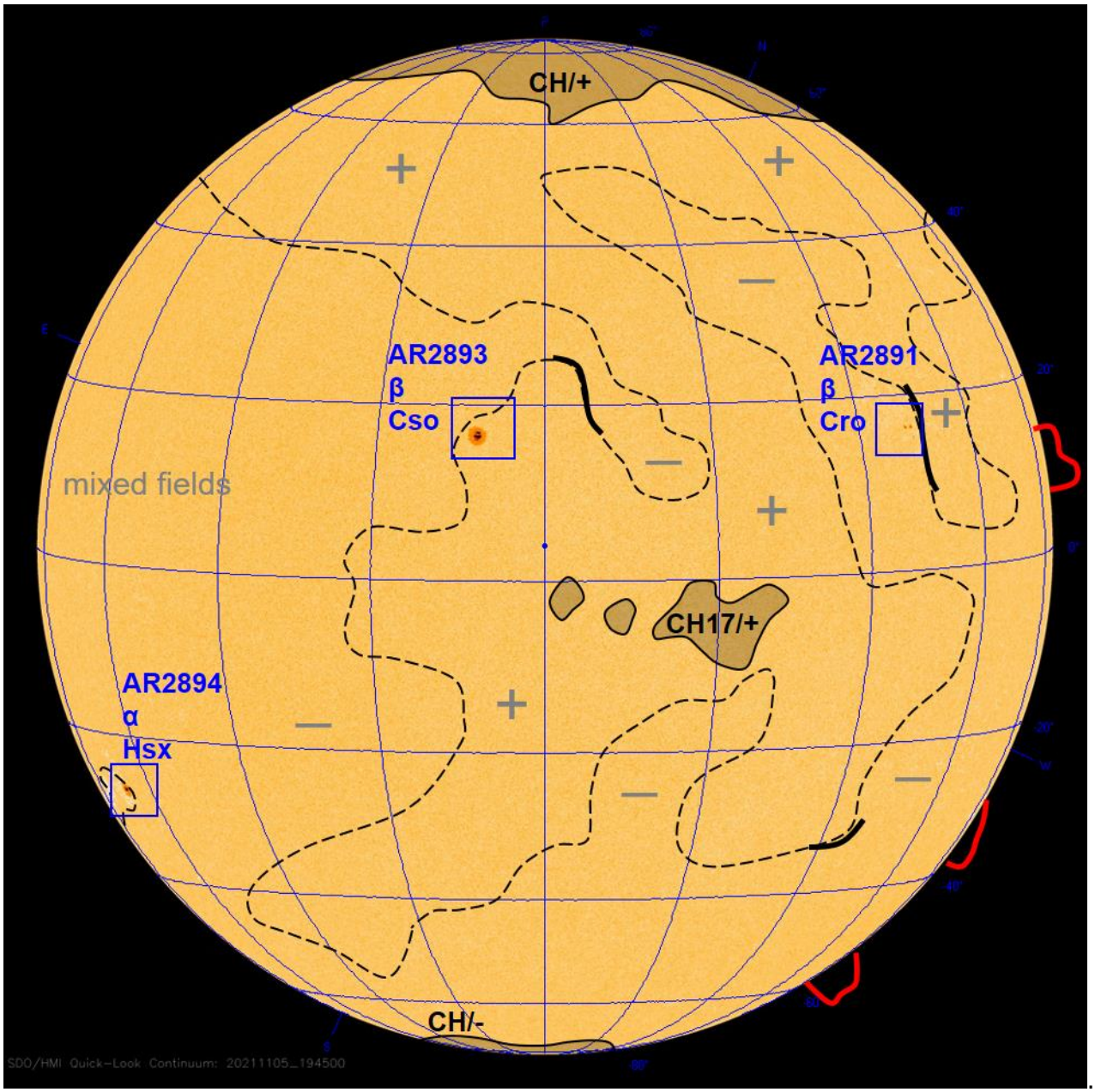
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain below the S1 minor storm level close to background levels. The high energy electron flux (greater than 2 MeV) is likely to reach high levels at times through the next 4 days, especially on diurnal peaks. Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) threshold, but an overall increasing trend is likely through the period. The Active threshold is likely to be breached between days 2 to 4 but there is only low confidence for the timing of this.

Figure 1. Solar Analysis Valid 05/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds have gradually and erratically reduced in speed following the passage of the 2nd November CME, although remain elevated near 530km/s. Geomagnetic activity has similarly decreased, with Quiet to Unsettled levels being observed through the period by BGS. No other Earth directed CMEs have been observed or are expected to be en-route at present.

Coronal hole (CH17/+) is located west of centre disc, and just south of the solar equator. This feature looks a little different to last rotation (it's further advanced this time around) and last time it was superseded by the arrival of a CME, meaning any forecast is low confidence. However, the most likely arrival time on this rotation is later on day 2 (7th) to early on day 3 (8th), with a wind speed of 500-550 km/s possible. STEREO-A appears to show signs of HSS influence around this time. However, wind speeds at Earth may still be raised above background levels from waning CME effects, so the HSS could effectively prolong the elevated wind speeds.

Quiet to Unsettled geomagnetic activity is expected through much of the period, but perhaps with an increased chance of Active to G1/Minor Storm intervals on days 2 to 3 (7th to 8th)

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	20	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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Radio Blackouts - X-Ray Flares:

There are currently three numbered regions on the visible disc. AR2891 (Cro/Beta) has continued to steadily fade, and has been re-classified to reflect it's weakened configuration. AR2893 (Cso/Beta) is little changed over the last few hours since the emergence of a small opposite polarity spot to the north of the main spot. Recently numbered region AR2894 (Hsx/Alpha) continues to transit into the southeast quarter, but it's proximity to the limb continues to make a complete assessment difficult at present. This is the source region of the largest flare in the past 24 hours, a C2 flare at 05/2156UTC.

A further potential active region is just beginning to show it's leading edge at the northeast horizon, and will be more fully assessed in subsequent updates as it rotates further into view. Solar Activity from the numbered regions on the visible disc is expected to be at Low levels, with a slight chance of isolated M-class flares, now most likely from AR2894. Probabilities have been tentatively increased from day 2 (7th) in anticipation of a possible new region rotating around the northeast limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16, has returned to background levels. AR2891 is now much less active and decaying steadily, with any new enhancements now considered a very low probability in the short term.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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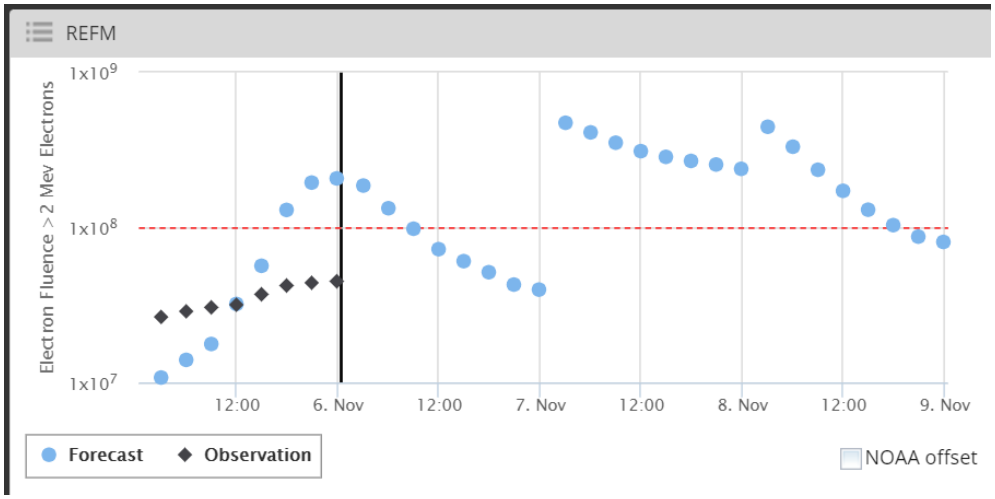
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) was at mostly moderate levels in the past 24 hours, with some brief peaks above the high threshold around the diurnal maximum, peak 1.82e3 at 05/1625UTC. Following the recent period of strong solar winds, and with speeds still elevated, a similar pattern is likely on day 1 (6th). Later on day 2 (7th) through to day 4 (9th) some connection with coronal hole 17/+ is likely. This should maintain a risk of exceeding the high threshold on diurnal peaks, perhaps with a slight rising trend through the period.

Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) level, but with a gradual increasing trend. An overall increasing trend is likely through the period due to anticipated coronal hole influence, The Active threshold is likely to be breached between days 2 to 4 but there is only low confidence for the timing of this. The Met Office REFM model is considered to be giving reasonable guidance in the overall trend, but is currently over-estimating fluence levels, and may be over-forecasting these levels in the forecast period.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	30	60	70	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	5	10	10

Figure 2: MOSWOC REFM electron fluence observation and forecast.



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